This amendment is being filed along with a Request for Continued Examination in response to the final Office Action mailed August 31, 2009. Reconsideration of the application is respectfully requested. Claims 1-16 were previously cancelled. Claims 17-39 were pending and rejected. Editorial amendments have been made to claims 17, 18, 24, and 39. These amendments are fully supported by the specification; no new matter is added. Further, since the amendments are merely editorial in nature, the amendments to not require new search. For reasons set forth below, Applicants submit the amendments place the application in condition of allowance. Thus, entry of the amendments is respectfully requested.

Rejection of Claims 17-23 under 35 U.S.C. § 103(a)

In "Claim Rejections - 35 USC § 103" on pages 2-5 of the Action, claims 17-23 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,933,146 to Wrigley (hereinafter "Wrigley") in view of U.S. Patent No. 6,597,359 to Lathrop (hereinafter "Lathrop"). However, because at least one element of the claims is not taught or suggested by the combination of Lathrop and Wrigley. Additionally, the combination of Lathrop and Wrigley is improper. Applicants therefore respectfully argue that the Action fails to make a *prima facie* case of obviousness and therefore the rejection is improper.

Rejection of Claims 17-23

Independent claim 17, as amended, recites, in part:

> after the object of intersection is stored in the list, preventing, by the computing device, the object of intersection from being intersected again by the ray.

For example, the Application describes the use of a "mailbox" which prevents multiple intersection computations for a ray and an object:

> *When a ray is cast, this mailbox notes which objects or triangles the ray intersects and prevents any one triangle or object from being intersected more than once by the ray. As a result, fewer ray-object, i.e. ray-triangle, intersection computations need to be carried out, and this accelerates the computation. The mailbox may be seen as a kind of intersection-computation*

cache, which, unlike a memory cache, does not prevent memory requests to
the memory but prevents intersection computations instead.

[Application, at page 11, last paragraph.] In its rejection of claim 17, the Action states that
"Wrigley does not clearly disclose preventing . . . the object from being intersected more than
once by the ray." [Action, at page 3.] However, the Action asserts such disclosure is found
in Lathrop, specifically at the Abstract and at column 2, lines 31-62. Applicants respectfully
disagree that Lathrop so teaches or describes.

*The object hierarchy and space subdivision techniques described in Lathrop serve
only to avoid computing intersections with an object altogether based on where it is located
in space, and thus do not teach or suggest "after the object of intersection is stored in the
list, preventing, by the computing device, the object of intersection from being intersected
again by the ray" as recited in claim 17.* As mentioned above, the Action cites only to the
Abstract and to column 2, lines 31-62 of Lathrop, stating that here Lathrop "discloses
techniques for reducing the number of ray to object intersection checks depending on the
number of objects." [Action, at page 3.] Applicants note that, even if this statement about
Lathrop were true, it would not teach or suggest "after the object of intersection is stored in
the list, preventing, by the computing device, the object of intersection from being intersected
again by the ray" as recited in claim 17 as this language does not recite any operations based
on a "number of objects."

Applicants furthermore find no teaching or suggestion in the cited passages of
Lathrop. The Abstract describes only that "[Lathrop's] invention performs the hierarchical
space subdivision technique of accelerating a ray tracer . . . ." [Lathrop, at Abstract.] No
detail of these techniques are described in the Abstract. The cited passage of column 2,
however, does describe particulars of these "object hierarchy" and "space subdivision"
techniques. Lathrop's "object hierarchy" techniques are described as follows:

The object hierarchy techniques group a set of objects together and
find a simple bounding volume that encloses the whole group, like a sphere or
a box. Rays are then intersected with the bounding volume. *If the ray does not
intersect the bounding volume then there is no need to check for intersection
with the objects inside the bounding volume, since none of these objects could
possibly intersect the ray.*

[Lathrop, at column 2, lines 33-40; emphasis added.] As the passage shows, Lathrop's "object hierarchy" simply avoids checking intersections *for entire objects*. Therefore it cannot teach or suggest "after the object of intersection is stored in the list, preventing . . . the object of intersection from being intersected again by the ray" as any object processed in this manner will never have *any* intersections checked with the ray.

Lathrop's "space subdivision" techniques similarly fail to teach or suggest this language of claim 17:

> The space subdivision techniques subdivide the scene volume instead of the list of objects. The scene space is subdivided into chunks. The data for each chunk contains a list of all the scene objects that could result in a positive ray/object intersection check within the chunk. *As a ray is traced, the chunk database is traversed in order along the ray. The ray is checked for intersection with all the objects in each chunk before proceeding to the next chunk along the ray. Only a small number of ray/object intersection checks are performed if the chunk only contains a small number of objects.*

[Lathrop, at column 2, lines 52-62; emphasis added.] As the passage shows, Lathrop's "space subdivision" technique simply reduces numbers of intersection checks by checking fewer objects; it does not prevent an object, after an intersection, from "being intersected again" as recited in claim 17. Indeed, as the passage clearly teaches that "[t]he ray is checked for intersection with all the objects in each chunk," Lathrop's technique could easily check intersections multiple times with an object in a chunk.

Applicants fail to see how either the cited passages of Lathrop teach or suggest the above-quoted language of claim 17.

Notwithstanding the above deficiency of Lathrop, it would also not have been obvious to modify Wrigley to combine with Lathrop, as Wrigley teaches away from "preventing . . . the object of intersection from being intersected again by the ray." Wrigley teaches that *all* intersections are computed for *all* surfaces before determining which intersections are nearer, and therefore visible:

> A ray tracing method . . . involves . . . repeating that step for all the other subsets *until all the paths have been tested for intersections against all surfaces in the scene.* The method also determines, for each path, which intersection is nearest the viewing position and stores data on the co-ordinates for that intersection and on the surface of the object or zone of illumination at that intersection.

[Wrigley, at Abstract; emphasis added.] Wrigley describes this technique again with respect to Figure 13:

> FIG. 13 shows the intersection computation unit 92 in more detail. *This unit determines all the intersections of each path with the bounding volumes (i.e. envelopes) and surfaces in the scene to be depicted,* and also uses logarithmic arithmetic to that end. *Subsequently, the intersections with object surfaces other than an intersection with an object surface closest to the origin of the vector are disregarded.*

[Wrigley, at column 7, lines 46-52; emphasis added.] As these passages show, Wrigley's teaching to compute all intersections and then to discard those that are not visible *teaches directly away* from the modification suggested by the combination with Lathrop.

Applicants also respectfully note that this particular deficiency of Wrigley was discussed in the Amendment filed May 27, 2009. Applicants acknowledge that the Action nominally addresses the argument, saying that "Applicant's arguments . . . are moot in view of the new ground(s) of rejection" and arguing that "Wrigley and Lathrop in addition to Lee et al. discloses the newly added features of claims 17-39." Applicants respectfully point out, however, that Applicants' argument is that Wrigley cannot be so modified, and request that the combination be reconsidered in light of this argument.

For at least these reasons, the rejection of claim 17, as amended, fails to establish a *prima facie* case of obviousness over Wrigley and Lathrop. The rejection of claim 17 under 35 U.S.C. § 103(a) is therefore improper. Additionally, while Applicants do not individually belabor the patentability of dependent claims 18-23, Applicants note that each recites, based on independent claim 17, at least one element not shown in Wrigley and Lathrop for the reasons discussed above. Claims 17-23 are thus patentable over Wrigley and Lathrop. Applicants respectfully request that the rejection of claims 17-23 under § 103(a) be withdrawn and that claims 17-23 be allowed.

Rejection of Claims 24-29 and 32-38 Under 35 U.S.C. 103(a)

In "Claim Rejections - 35 USC § 103" on pages 6-10 of the Action, claims 24-29 and 32-38 were rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No.

5,933,146 to Wrigley (hereinafter "Wrigley") in view of U.S. Patent No. 6,597,359 to Lathrop (hereinafter "Lathrop").

Independent claims 24 and 32 each recite language similar to that discussed above with respect to claim 17. Claim 24, for example, recites:

> a decision unit operatively configured such that, when ray-object intersection data has been computed for a given ray and a given object, the decision unit prevents additional ray-object intersection computations from being carried out for the given ray and the given object.

Claim 32 recites:

> prevent[ing] objects that have already been intersected by a ray during ray tracing from being intersected again by the ray.

In its rejection of the above-quoted language of claims 24 and 32, the Action notes similar deficiencies in Wrigley as those discussed above with respect to claim 17, and cites to the same passage of Lathrop. Thus, for at least the reasons discussed above with respect to claim 17, the rejection of claims 24 and 32 over Wrigley and Lathrop is improper. Claims 24 and 32 are patentable over Wrigley and Lathrop, as are claims 25-29 and 33-38, which depend from claims 17 and 32 respectively and thus incorporate the recitations of the independent claims. Applicants respectfully request that the rejection of claims 24-29 and 32-38 under § 103(a) be withdrawn and that the claims be allowed.

Rejection of Claims 30, 31, and 39 Under 35 U.S.C. 103(a)

Additionally, Claims 30, 31, and 39 were rejected under 35 U.S.C. § 103(a) over Wrigley in view of Lathrop and further in view of U.S. Patent Application Publication No. 2004/0233222 to Lee et al. (hereinafter "Lee").

It is respectfully submitted that Lee does not make up for the lack of teaching in Wrigley and Lathrop as described above. Therefore, independent claim 24 remains patentable over Wrigley and Lathrop even when combined with Lee. Claims 30 and 31 depend from claim 24, therefore, for at least similar reasons to those discussed above, claims 30 and 31 are allowable over the cited references.

Claim 39, as amended, recites, in part:

> the decision unit configured to prevent objects whose object addresses are stored in the list from being intersected again by the ray . . . .

In its rejection of the above-quoted language of claim 39, the Action notes similar deficiencies in Wrigley as those discussed above with respect to claim 17, and cites to the same passage of Lathrop. Claim 39 is thus patentable over Wrigley and Lathrop. And as with claims 30 and 31, Lee does not make up for the lack of teaching in Wrigley and Lathrop. Therefore, claim 39 remains patentable over Wrigley and Lathrop even when combined with Lee.

Applicants respectfully request that the rejections of claims 30, 31, and 39 under 35 U.S.C. § 103(a) be withdrawn and that the claims be allowed.

Conclusion

All pending claims are in a condition for allowance. Accordingly, a Notice of Allowance is respectfully requested. If the Examiner has any questions concerning the present paper, the Examiner is kindly requested to contact the undersigned at (206) 407-1561. If any fees are due in connection with filing this paper, the Commissioner is authorized to charge the Deposit Account of Schwabe, Williamson and Wyatt, P.C., No. 500393.

Respectfully submitted,
SCHWABE, WILLIAMSON & WYATT, P.C.

Date: October 28, 2009   by: /Al AuYeung/
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